WHAT IS CLAIMED IS:

1. A method for determining a response to administration of a chemotherapeutic or chemopreventive agent to an individual, comprising:

(a) collecting a first tissue or cell sample from the individual before exposing the individual to the chemotherapeutic or chemopreventive agent;

(b) collecting a second tissue or cell sample from the individual after exposing the individual to the chemotherapeutic or chemopreventive agent;

(c) immunohistochemically staining the first and second tissue or cell samples using a detectably-labeled antibody directed against a biological marker associated with senescence, apoptosis or terminal differentiation;

(d) measuring the optical density of the stained cells as in step (c), wherein the stained cells are illuminated with light having a wavelength absorbed by the stain;

(e) determining whether expression of the biological marker associated with senescence, apoptosis or terminal differentiation was increased following exposure to the chemotherapeutic or chemopreventive agent.

2. The method of claim 1, wherein the detectable label is a chromagen or a fluoraphore.

3. The method of claim 2, wherein the biological marker is p21, p27, p16, TGF-β, or SA-β-Gal.

4. The method of claim 1, wherein the amount of biological marker protein is determined by ELISA assay.

5. The method of claim 1, wherein optical density of the stained cells is performed by image analysis.

6. The method of claim 5, wherein image analysis is performed by splitting a signal comprising the optical density of the stained biological sample into a multiplicity of signals that are processed using optical filters having different absorption and transmittance properties, so

that each signal is specific for one of a multiplicity of stains used to stain the cells in the biological sample.